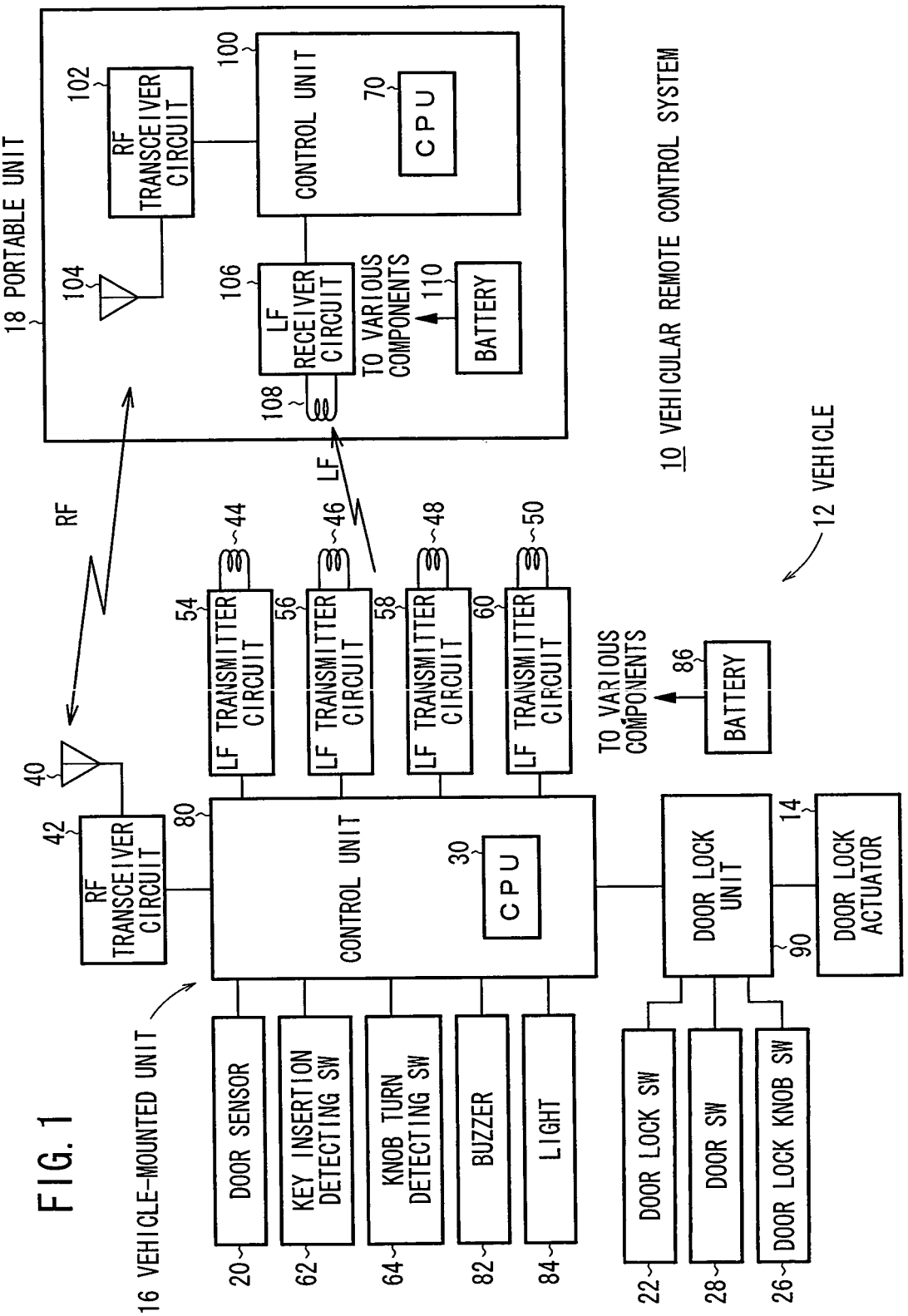

18 PORTABLE UNIT
RF TRANSCEIVER CIRCUIT
102
CONTROL UNIT
100
CPU
70
104
106
LF RECEIVER CIRCUIT
TO VARIOUS COMPONENTS
110
BATTERY
108
RF
LF
10 VEHICULAR REMOTE CONTROL SYSTEM
12 VEHICLE
44
46
48
50
54
56
58
60
LF TRANSMITTER CIRCUIT
LF TRANSMITTER CIRCUIT
LF TRANSMITTER CIRCUIT
LF TRANSMITTER CIRCUIT
TO VARIOUS COMPONENTS
86
BATTERY
40
42
RF TRANSCEIVER CIRCUIT
80
CONTROL UNIT
30
CPU
DOOR LOCK UNIT
14
DOOR LOCK ACTUATOR
90
16 VEHICLE-MOUNTED UNIT
DOOR SENSOR
KEY INSERTION DETECTING SW
KNOB TURN DETECTING SW
BUZZER
LIGHT
DOOR LOCK SW
DOOR SW
DOOR LOCK KNOB SW
20
62
64
82
84
22
28
26

FIG. 1

FIG. 2

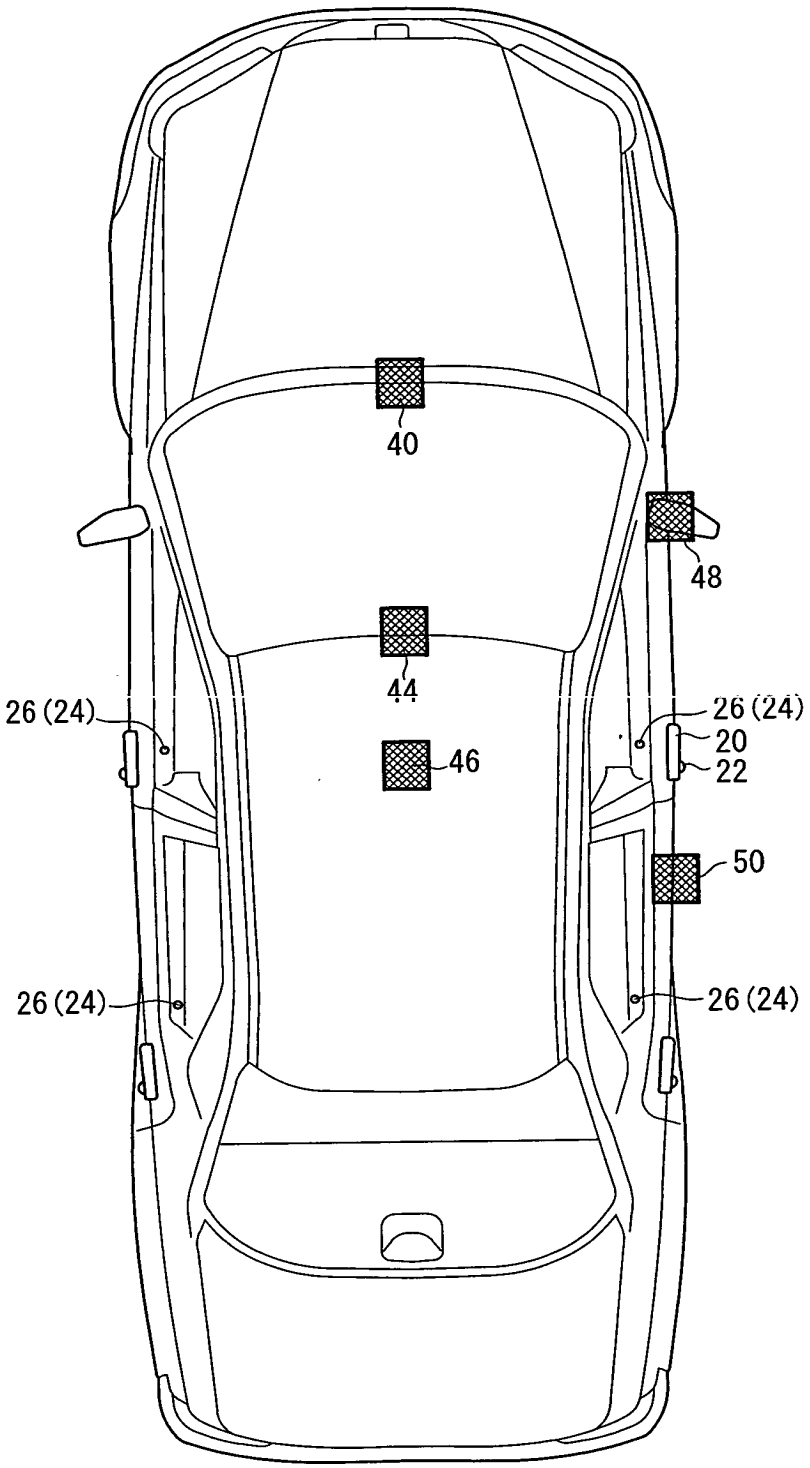


FIG. 3

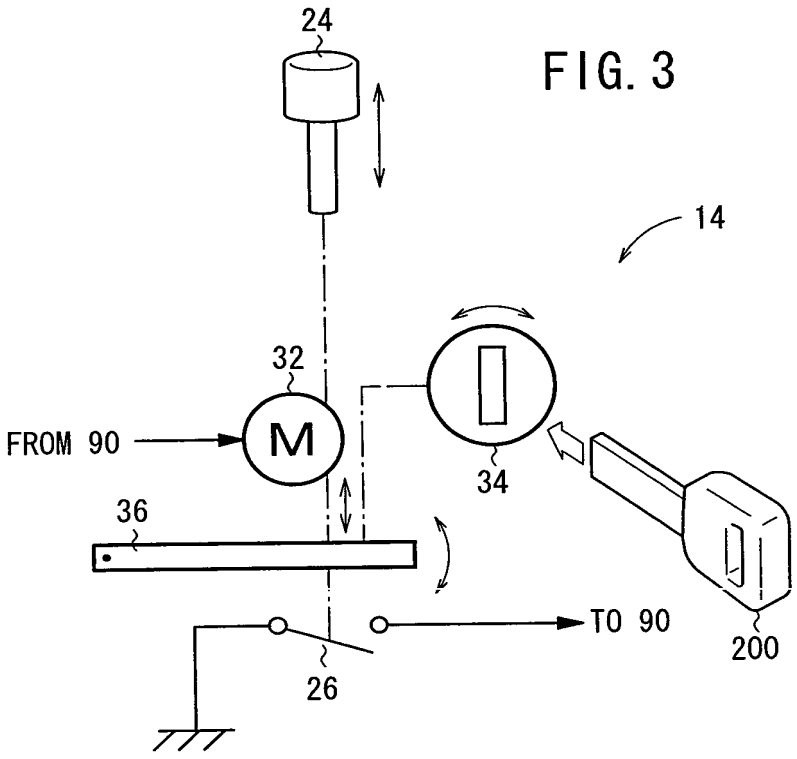


FIG. 4

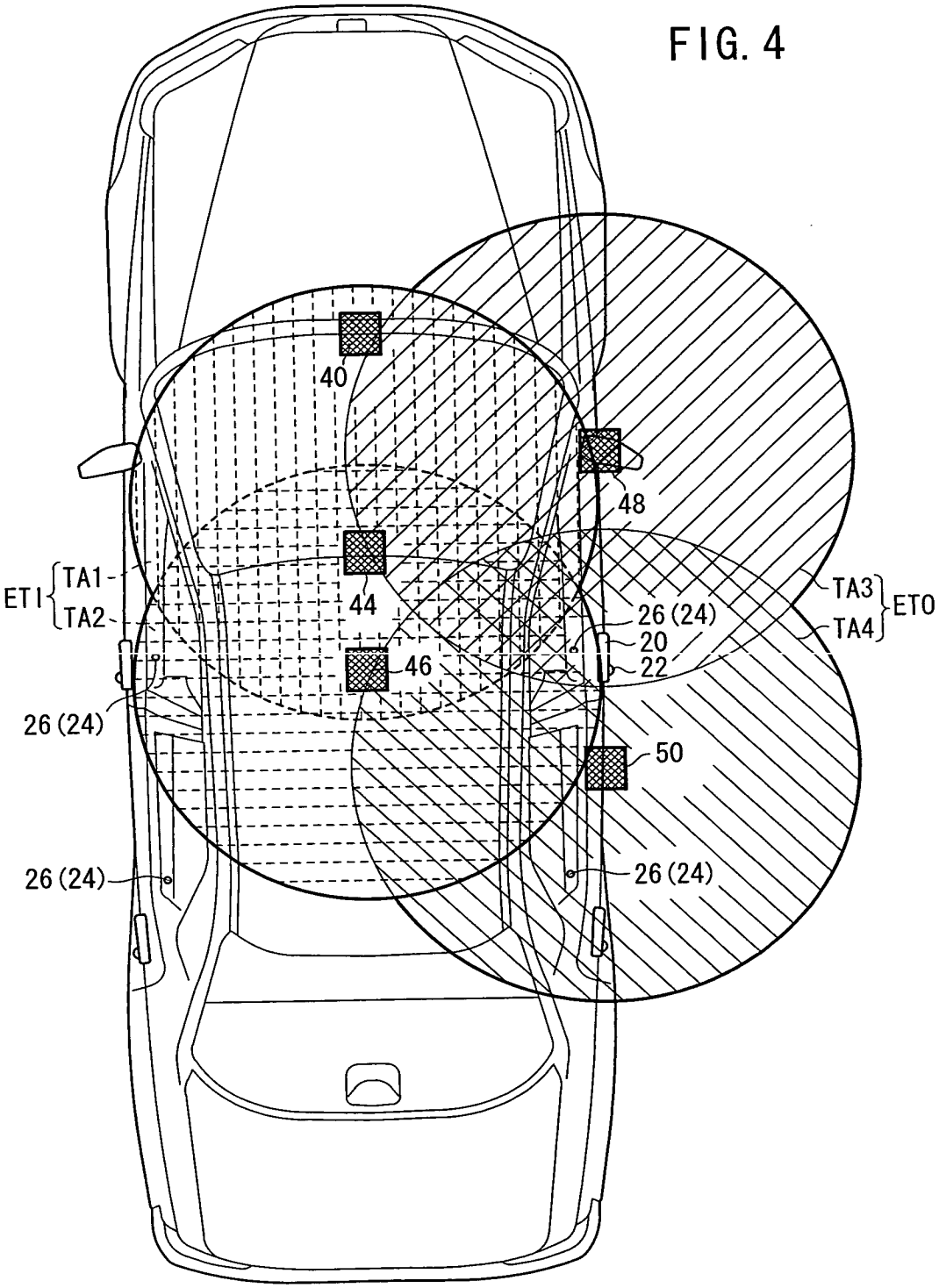


FIG. 5

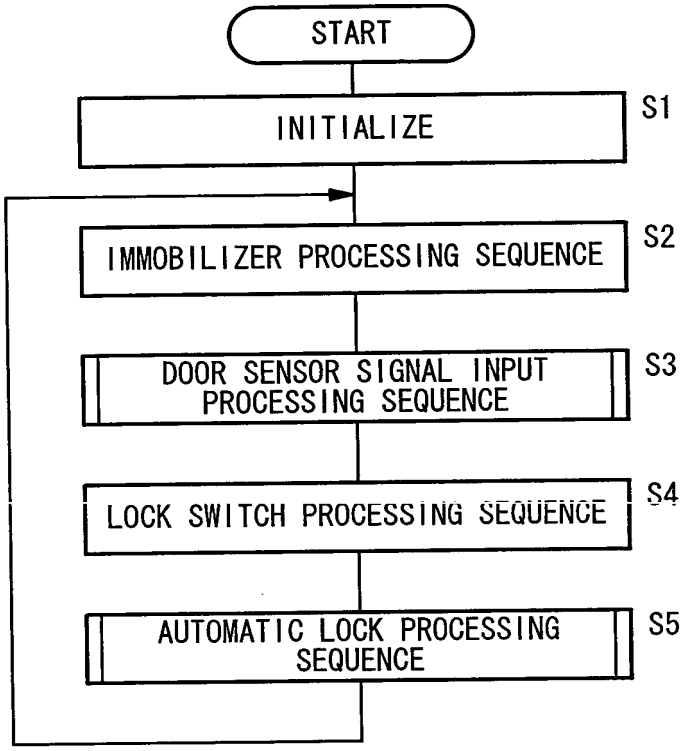

START
INITIALIZE
S1
IMMOBILIZER PROCESSING SEQUENCE
S2
DOOR SENSOR SIGNAL INPUT PROCESSING SEQUENCE
S3
LOCK SWITCH PROCESSING SEQUENCE
S4
AUTOMATIC LOCK PROCESSING SEQUENCE
S5

FIG. 6

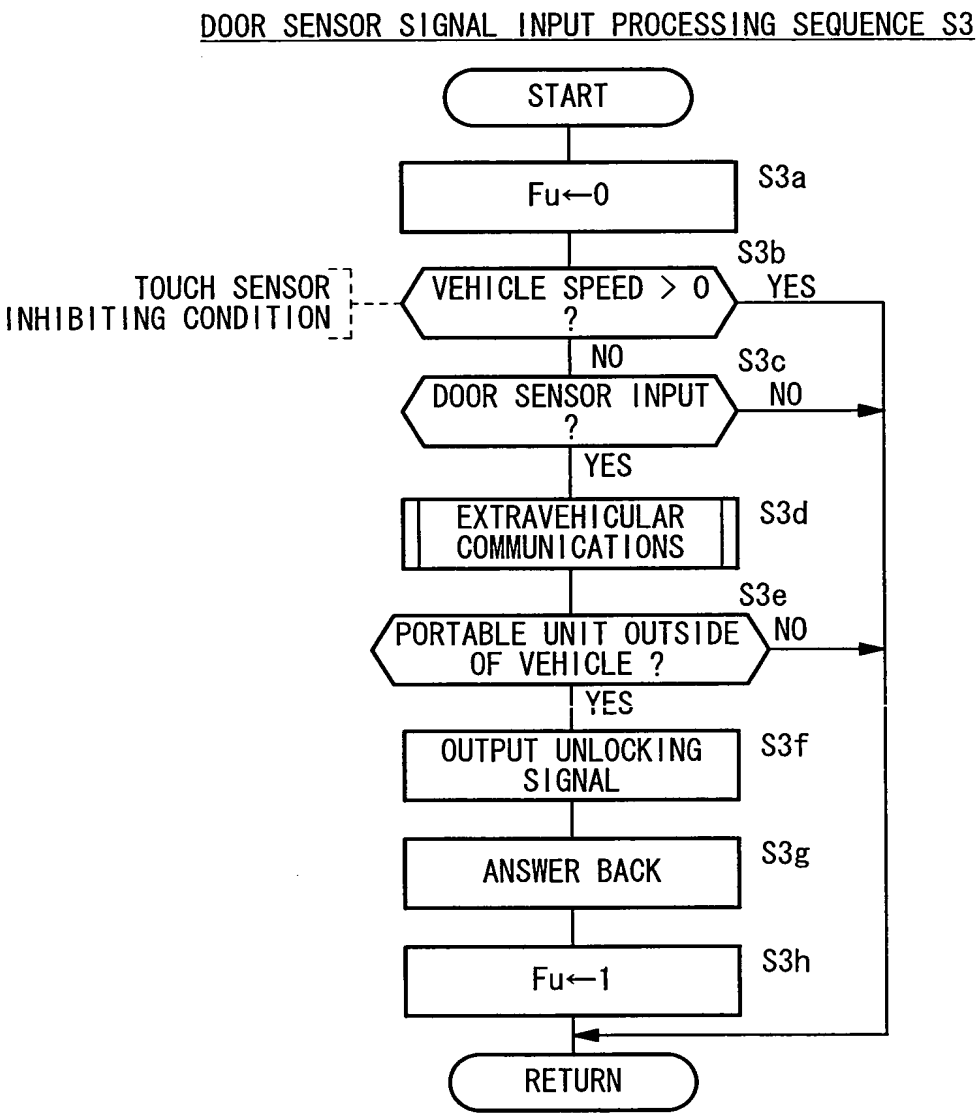

DOOR SENSOR SIGNAL INPUT PROCESSING SEQUENCE S3
START
Fu←0
S3a
S3b
TOUCH SENSOR INHIBITING CONDITION
VEHICLE SPEED > 0 ?
YES
NO
S3c
DOOR SENSOR INPUT ?
NO
YES
EXTRAVEHICULAR COMMUNICATIONS
S3d
S3e
PORTABLE UNIT OUTSIDE OF VEHICLE ?
NO
YES
OUTPUT UNLOCKING SIGNAL
S3f
ANSWER BACK
S3g
Fu←1
S3h
RETURN

FIG. 7 EXTRAVEHICULAR COMMUNICATION PROCESSING SEQUENCE

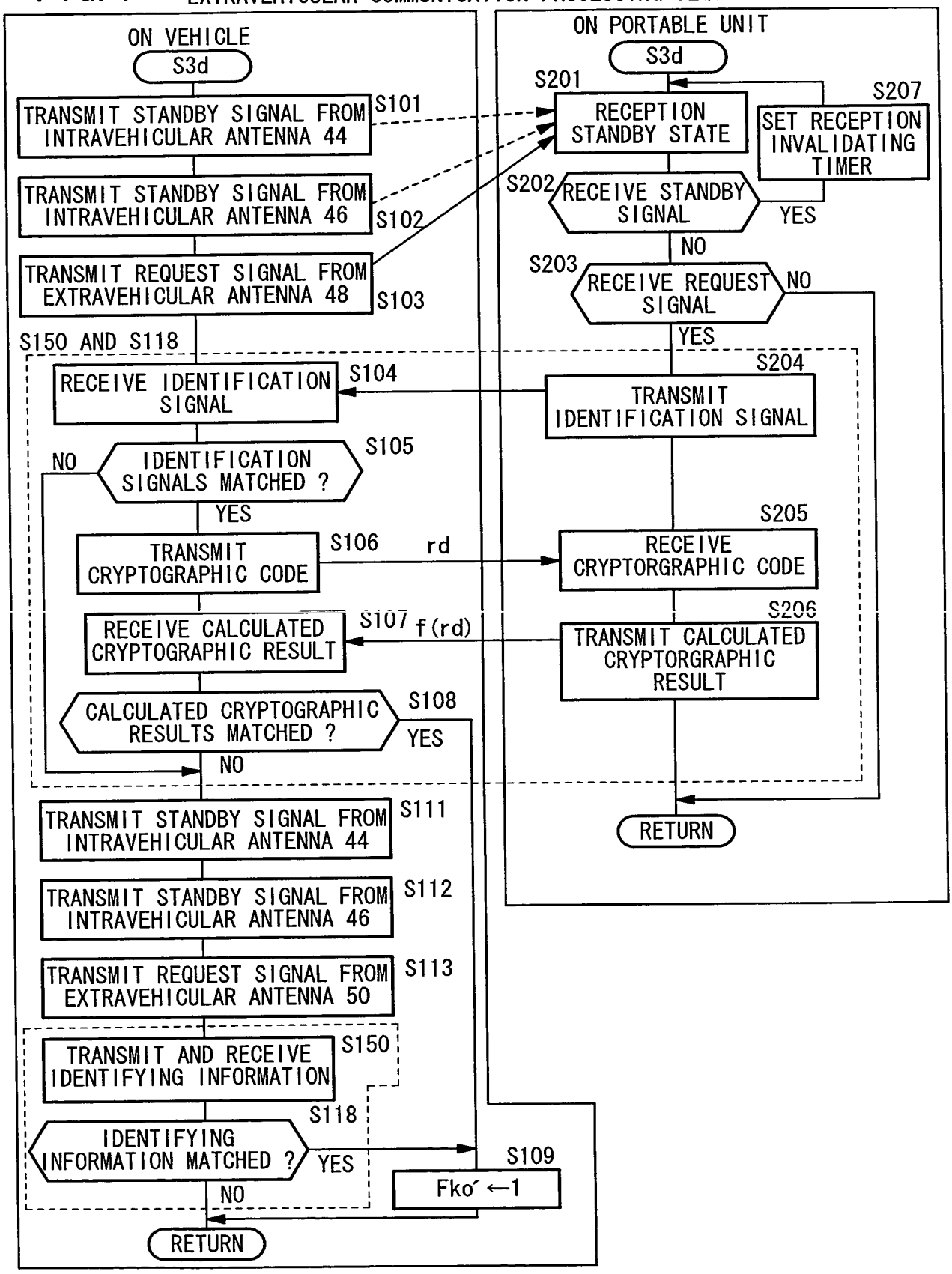
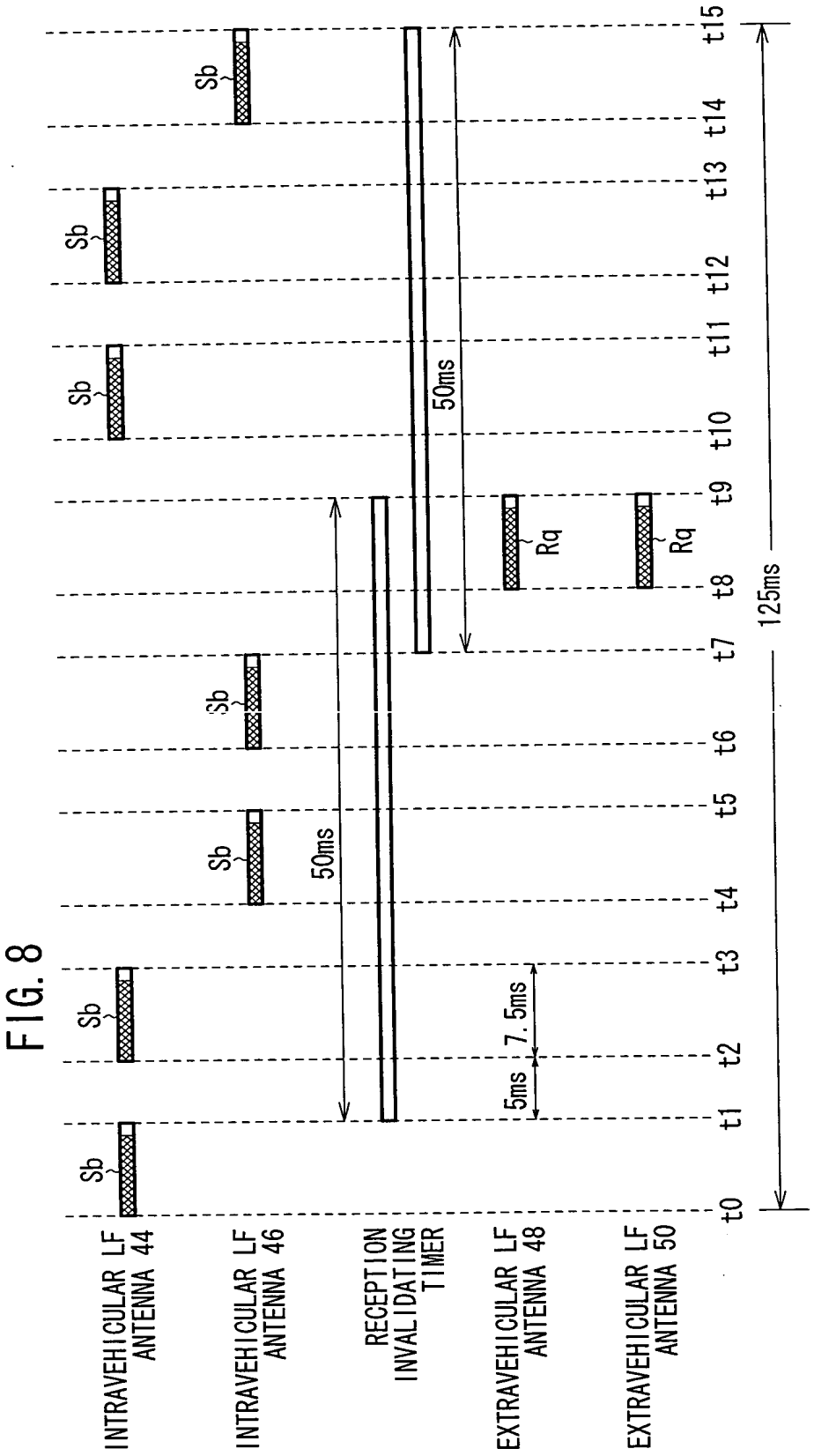


FIG. 8


t0
t1
t2
t3
t4
t5
t6
t7
t8
t9
t10
t11
t12
t13
t14
t15
125ms
Sb
Rq
50ms
7.5ms
5ms
INTRAVEHICULAR LF ANTENNA 44
INTRAVEHICULAR LF ANTENNA 46
RECEPTION INVALIDATING TIMER
EXTRAVEHICULAR LF ANTENNA 48
EXTRAVEHICULAR LF ANTENNA 50

AUTOMATIC LOCKING PROCESSING SEQUENCE

FIG. 9

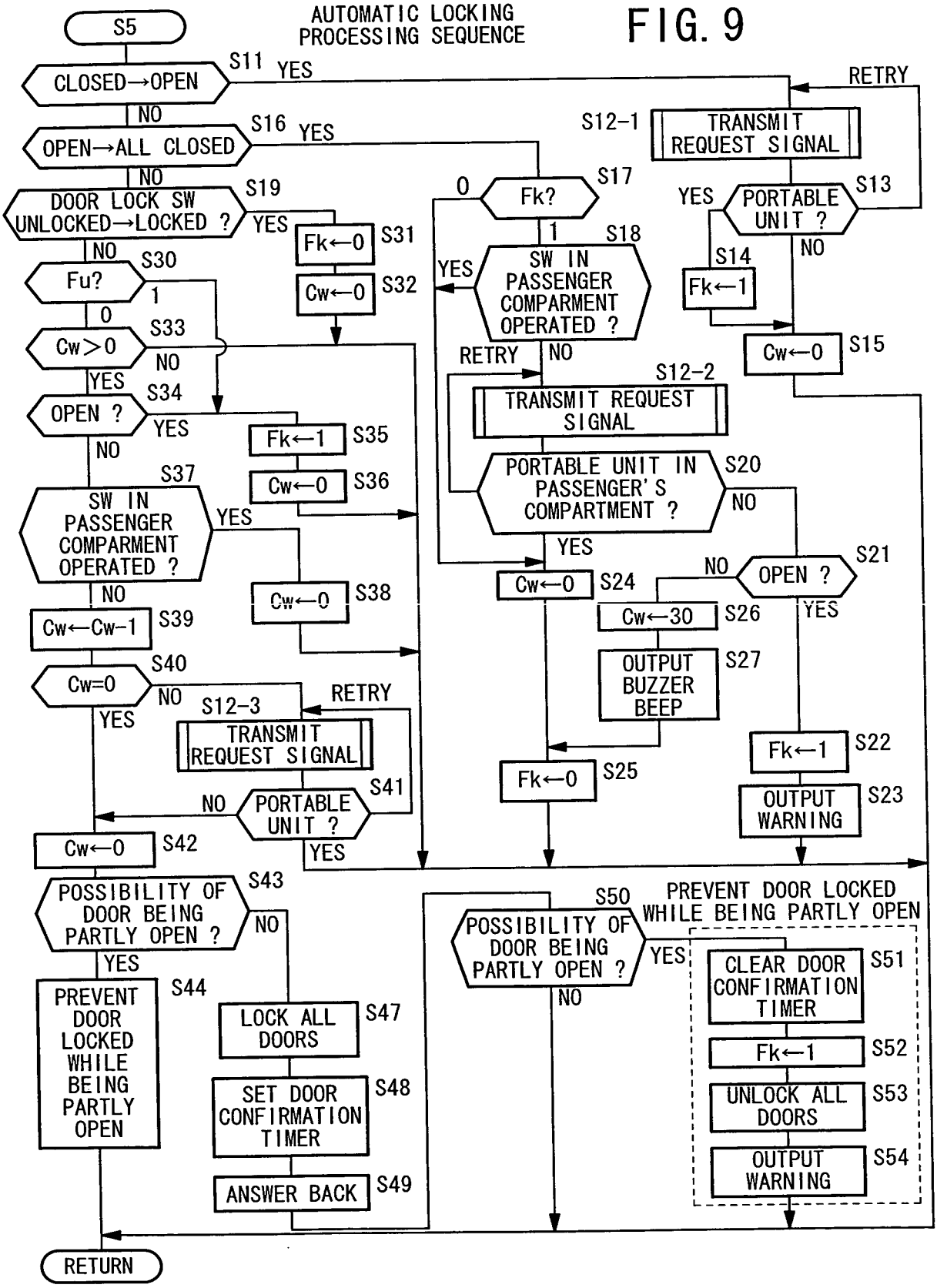


FIG. 10

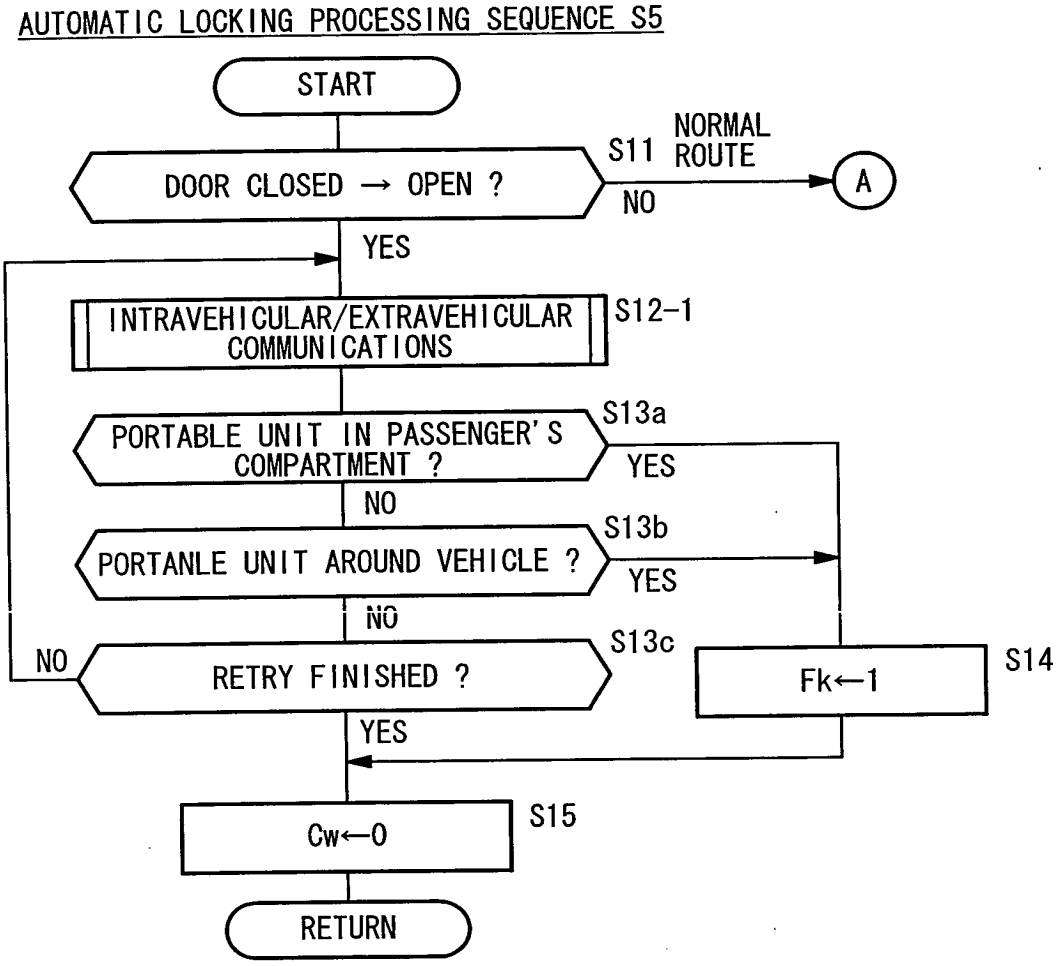

AUTOMATIC LOCKING PROCESSING SEQUENCE S5
START
DOOR CLOSED → OPEN ?
S11
NORMAL ROUTE
A
NO
YES
INTRAVEHICULAR/EXTRAVEHICULAR COMMUNICATIONS
S12-1
PORTABLE UNIT IN PASSENGER'S COMPARTMENT ?
S13a
YES
NO
PORTANLE UNIT AROUND VEHICLE ?
S13b
YES
NO
NO
RETRY FINISHED ?
S13c
Fk←1
S14
YES
Cw←0
S15
RETURN

FIG. 11

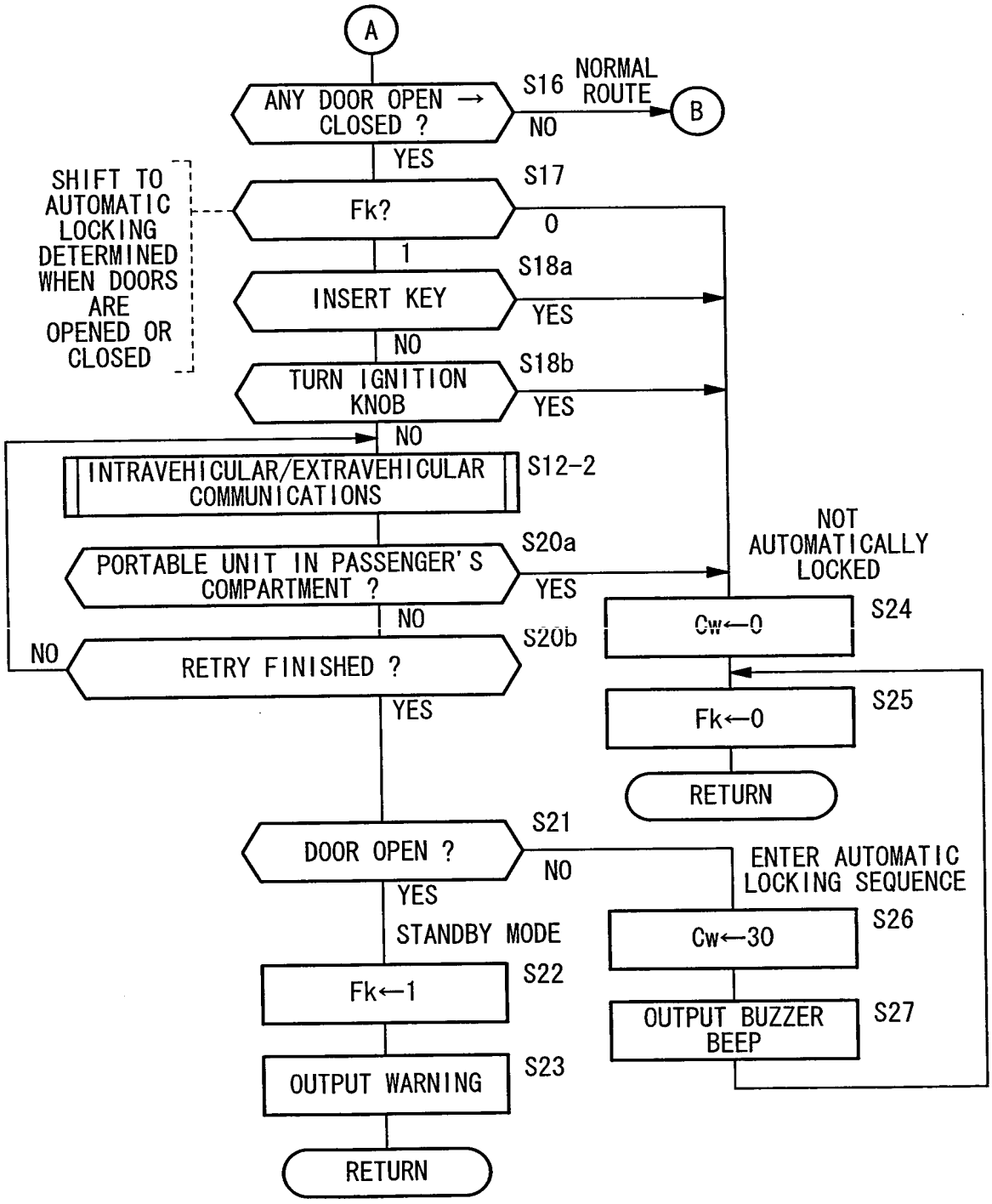

A
ANY DOOR OPEN → CLOSED ?
S16
NORMAL ROUTE
B
NO
YES
SHIFT TO AUTOMATIC LOCKING DETERMINED WHEN DOORS ARE OPENED OR CLOSED
Fk?
S17
0
1
INSERT KEY
S18a
YES
NO
TURN IGNITION KNOB
S18b
YES
NO
INTRAVEHICULAR/EXTRAVEHICULAR COMMUNICATIONS
S12-2
PORTABLE UNIT IN PASSENGER'S COMPARTMENT ?
S20a
YES
NO
RETRY FINISHED ?
S20b
NO
YES
NOT AUTOMATICALLY LOCKED
Cw←0
S24
Fk←0
S25
RETURN
DOOR OPEN ?
S21
NO
YES
ENTER AUTOMATIC LOCKING SEQUENCE
STANDBY MODE
Cw←30
S26
Fk←1
S22
OUTPUT BUZZER BEEP
S27
OUTPUT WARNING
S23
RETURN

FIG. 12

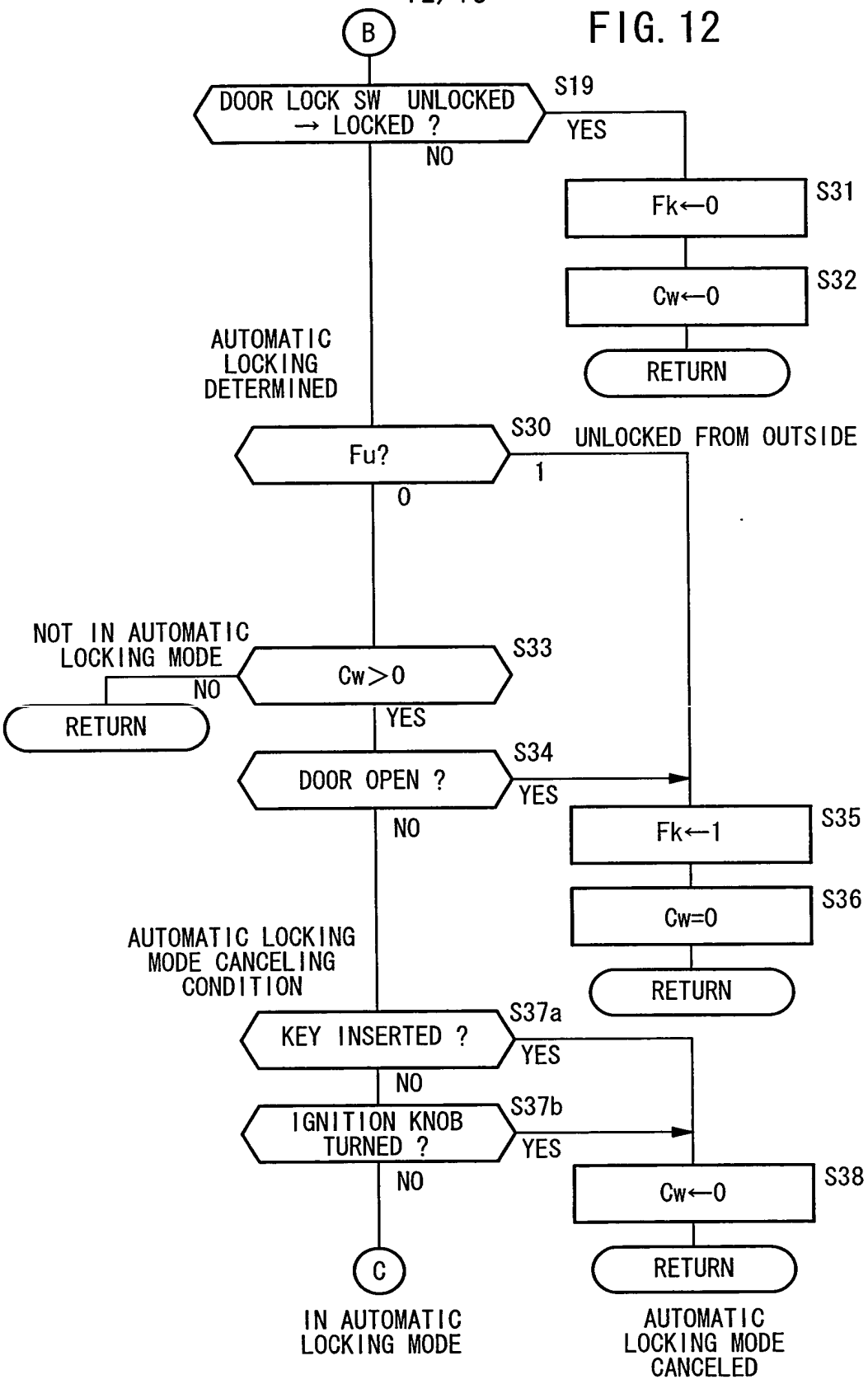

B
DOOR LOCK SW UNLOCKED → LOCKED ?
S19
YES
NO
Fk←0
S31
Cw←0
S32
RETURN
AUTOMATIC LOCKING DETERMINED
Fu?
S30
UNLOCKED FROM OUTSIDE
1
0
NOT IN AUTOMATIC LOCKING MODE
Cw>0
S33
NO
RETURN
YES
DOOR OPEN ?
S34
YES
NO
Fk←1
S35
Cw=0
S36
RETURN
AUTOMATIC LOCKING MODE CANCELING CONDITION
KEY INSERTED ?
S37a
YES
NO
IGNITION KNOB TURNED ?
S37b
YES
NO
Cw←0
S38
RETURN
C
IN AUTOMATIC LOCKING MODE
AUTOMATIC LOCKING MODE CANCELED

FIG. 13

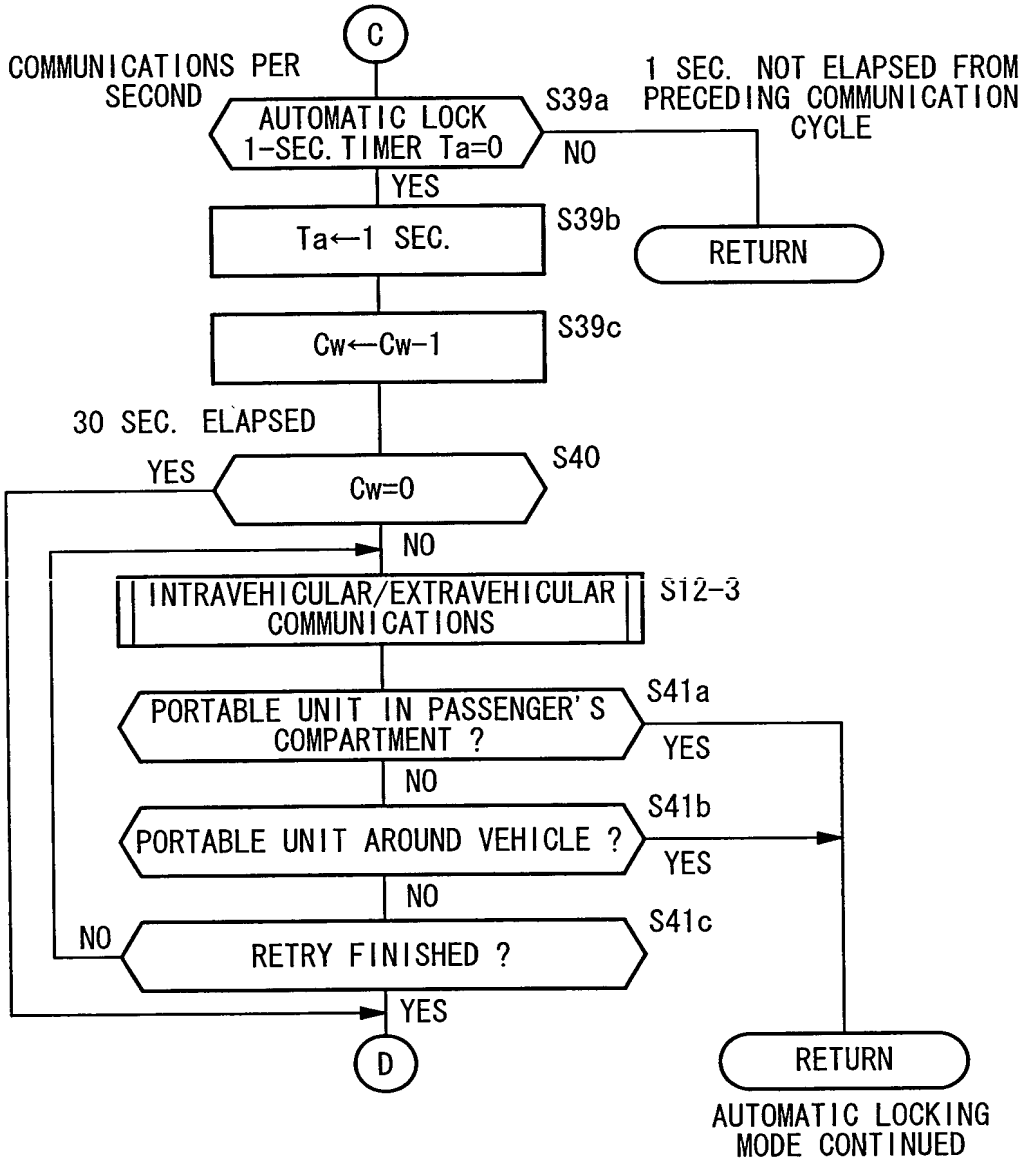

C
COMMUNICATIONS PER SECOND
AUTOMATIC LOCK 1-SEC. TIMER Ta=0
S39a
NO
1 SEC. NOT ELAPSED FROM PRECEDING COMMUNICATION CYCLE
RETURN
YES
Ta←1 SEC.
S39b
Cw←Cw-1
S39c
30 SEC. ELAPSED
YES
Cw=0
S40
NO
INTRAVEHICULAR/EXTRAVEHICULAR COMMUNICATIONS
S12-3
PORTABLE UNIT IN PASSENGER'S COMPARTMENT ?
S41a
YES
NO
PORTABLE UNIT AROUND VEHICLE ?
S41b
YES
NO
NO
RETRY FINISHED ?
S41c
YES
D
RETURN
AUTOMATIC LOCKING MODE CONTINUED

FIG. 14

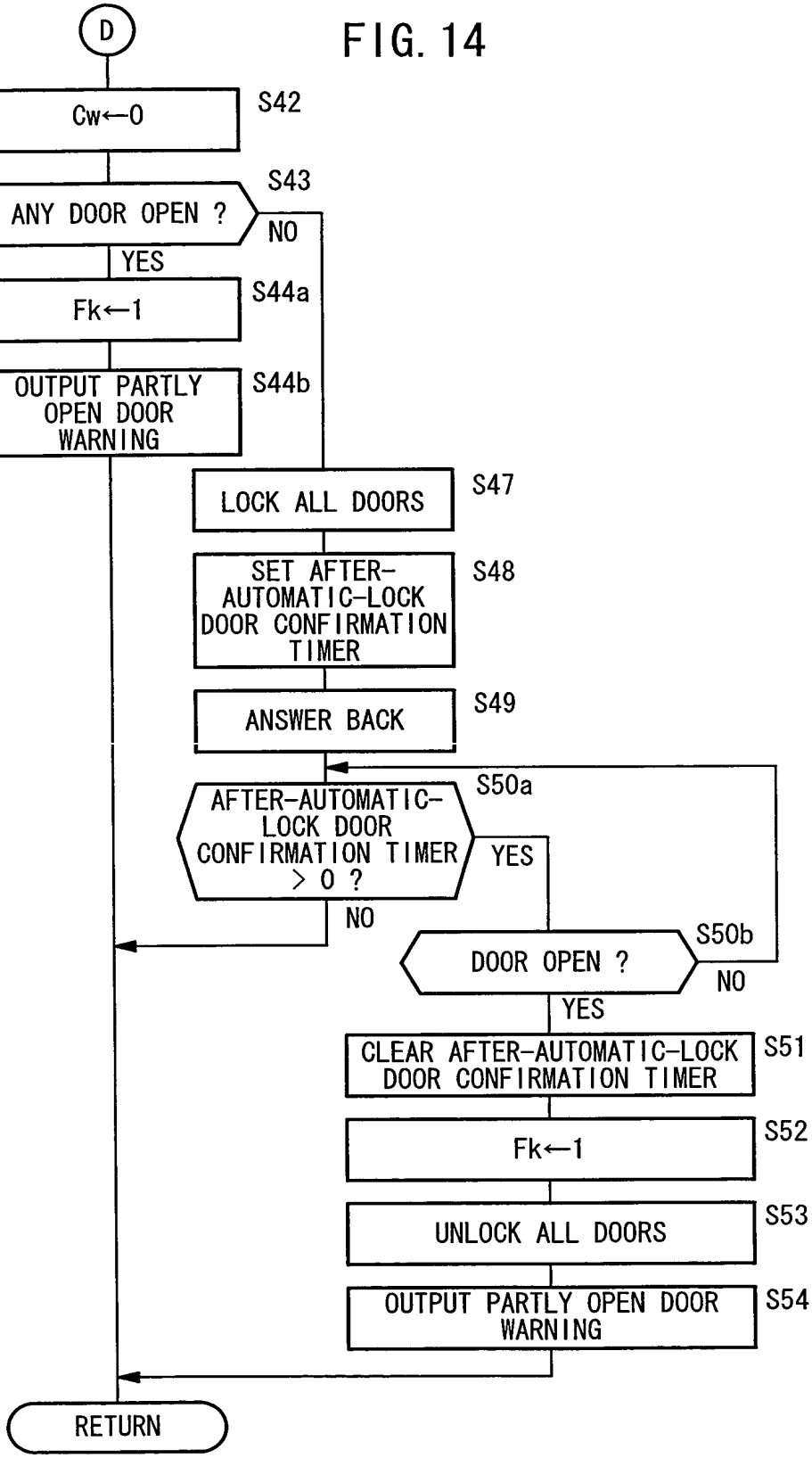
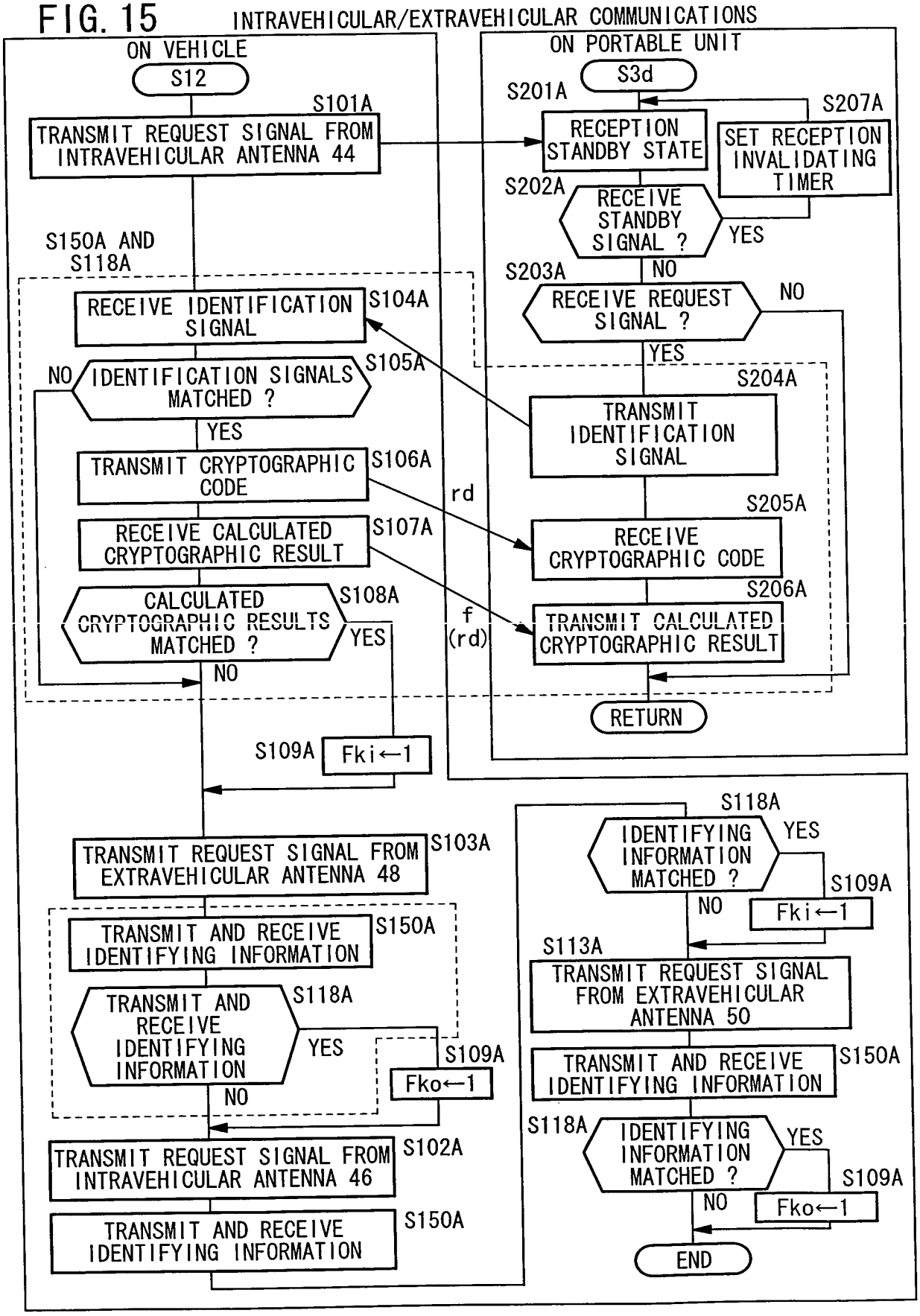

D
Cw←0
S42
ANY DOOR OPEN ?
S43
NO
YES
Fk←1
S44a
OUTPUT PARTLY OPEN DOOR WARNING
S44b
LOCK ALL DOORS
S47
SET AFTER-AUTOMATIC-LOCK DOOR CONFIRMATION TIMER
S48
ANSWER BACK
S49
AFTER-AUTOMATIC-LOCK DOOR CONFIRMATION TIMER > 0 ?
S50a
YES
NO
DOOR OPEN ?
S50b
NO
YES
CLEAR AFTER-AUTOMATIC-LOCK DOOR CONFIRMATION TIMER
S51
Fk←1
S52
UNLOCK ALL DOORS
S53
OUTPUT PARTLY OPEN DOOR WARNING
S54
RETURN

FIG. 15


INTRAVEHICULAR/EXTRAVEHICULAR COMMUNICATIONS
ON VEHICLE
S12
S101A
TRANSMIT REQUEST SIGNAL FROM INTRAVEHICULAR ANTENNA 44
S150A AND S118A
RECEIVE IDENTIFICATION SIGNAL
S104A
NO
IDENTIFICATION SIGNALS MATCHED ?
S105A
YES
TRANSMIT CRYPTOGRAPHIC CODE
S106A
RECEIVE CALCULATED CRYPTOGRAPHIC RESULT
S107A
CALCULATED CRYPTOGRAPHIC RESULTS MATCHED ?
S108A
YES
NO
S109A
Fki←1
TRANSMIT REQUEST SIGNAL FROM EXTRAVEHICULAR ANTENNA 48
S103A
TRANSMIT AND RECEIVE IDENTIFYING INFORMATION
S150A
TRANSMIT AND RECEIVE IDENTIFYING INFORMATION
S118A
YES
S109A
Fko←1
NO
TRANSMIT REQUEST SIGNAL FROM INTRAVEHICULAR ANTENNA 46
S102A
TRANSMIT AND RECEIVE IDENTIFYING INFORMATION
S150A
ON PORTABLE UNIT
S3d
S201A
RECEPTION STANDBY STATE
S207A
SET RECEPTION INVALIDATING TIMER
S202A
RECEIVE STANDBY SIGNAL ?
YES
NO
S203A
RECEIVE REQUEST SIGNAL ?
NO
YES
S204A
TRANSMIT IDENTIFICATION SIGNAL
rd
S205A
RECEIVE CRYPTOGRAPHIC CODE
S206A
f (rd)
TRANSMIT CALCULATED CRYPTOGRAPHIC RESULT
RETURN
S118A
IDENTIFYING INFORMATION MATCHED ?
YES
S109A
NO
Fki←1
S113A
TRANSMIT REQUEST SIGNAL FROM EXTRAVEHICULAR ANTENNA 50
TRANSMIT AND RECEIVE IDENTIFYING INFORMATION
S150A
S118A
IDENTIFYING INFORMATION MATCHED ?
YES
S109A
NO
Fko←1
END